$1.00

Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

294-2 AMP-CLAMP® AMMETER
295-2 AMP-CLAMP® VOLT AMMETER
296-2 AMP-CLAMP® VOLT-OHM AMMETER

WARNING

For safe usage, it is essential that the operator read this manual carefully before using the instrument for any measurements.

SIMPSON ELECTRIC COMPANY

853 Dundee Ave., Elgin, Illinois 60120

Area Code 312, Telephone 697-2260

In Canada, Bach-Simpson, Ltd., London, Ontario

Warranty

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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ELECTRIC COMPANY
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OPERATOR'S MANUAL

SIMPSON
294-2 AMP-CLAMP® AMMETER
295-2 AMP-CLAMP® VOLT AMMETER
296-2 AMP-CLAMP® VOLT-OHM AMMETER

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EFFECTIVE DATE: Immediately

EDITION: 1st

Part No. 6-111126

Figure 1-1. Simpson Amp-Clamp

TABLE OF CONTENTS

SECTION I
Introduction 1-1
1.1 General 1-1
1.2 Supplies and Accessories 1-2
1.3 Safety Considerations 1-2
1.4 Technical Data 1-2

SECTION II
Installation 2-1
2.1 General 2-1
2.2 Unpacking and Inspection 2-1
2.3 Shipping 2-2
2.4 Warranty 2-2
2.5 Power Source Requirements 2-3
2.6 Installation 2-3
2.7 Care 2-3

SECTION III
Controls, Connector and Indicator 3-1
3.1 General 3-1
3.2 Description 3-1

SECTION IV
Operation 4-1
4.1 General 4-2
4.2 Safety Considerations 4-2
4.3 AC Current Measurements, 294-2/295-2/296-2: 4-4
4.4 AC Voltage Measurements, 295-2 and 296-2: 4-5
4.5 Resistance Measurements, 296-2: ... 4-6
4.6 Application Information 4-7

SECTION V
Theory of Operation 5-1
5.1 AC Current Measurements 5-1

Table of Contents

5.2 AC Voltage Measurements 5-2
5.3 Resistance Measurements 5-2

SECTION VI
Operator Servicing 6-1
6.1 General 6-1
6.2 Battery Installation (296-2 Only) ... 6-1
6.3 Battery Removal 6-1
6.4 Fuse 6-3

SECTION VII
Servicing Instructions 7-1
7.1 General 7-1
7.2 Replacement Parts and Schematic Diagram 7-1

LIST OF TABLES
1-1 Technical Data 1-3
1-2 Items and Accessories Included with This Instrument 1-4
1-3 Additional Accessories 2-1
3-1 Controls, Connectors and Indicator .. 3-1
7-1 Replacement Parts List (294-2) 7-1
7-2 Replacement Parts List (295-2) 7-2
7-3 Replacement Parts List (296-2) 7-4

LIST OF ILLUSTRATIONS
1-1 Simpson Amp-Clamp ii
3-1 Controls, Connectors and Indicator . 3-3
4-1 Increasing Sensitivity of Amp-Clamp 4-8
6-1 Battery Installation and Fuse Location (296-2 Only) 6-2
7-1 Schematic Diagram (294-2) 7-6
7-2 Schematic Diagram (295-2) 7-7
7-3 Schematic Diagram (296-2) 7-8

SAFETY SYMBOLS

This marking, adjacent to another marking, terminal, or operating device, indicates that the Operator must refer to an explanation in the operating instructions to avoid damage to the equipment and/or to avoid personal injury.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly performed or adhered to, could result in personal injury.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly adhered to could result in damage to or destruction of part or all of the Instrument.

NOTE: This Operator's Manual contains information essential to the operation of this Instrument. Therefore, it should be kept in a convenient place and used for reference as required.

WARNING

These Instruments are designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.

SHOCK HAZARD: As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage current consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current

that flows through the resistor. The Simpson Model 229 - Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect a 1500 ohm non-inductive resistor in series with a Simpson 0-500 DC micrommeter and use this as the measuring instrument.

SECTION I
INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson Amp-Clamps, 294-2/295-2/296-2 (hereafter referred to as the Amp-Clamp[s] or the Instrument[s]) will be discussed herein, along with pertinent facts which distinguish each of them from the other.

1.1.2 These Instruments are analog readout devices designed for general-purpose testing. They have self-shielded, core-type movements. Each of them is protected from overload by a varistor. Other features include an indicator and a pointer lock lever for later observations of the indicated value. Current measurements can be made with these Instruments without disconnecting or breaking into the line being checked. By clamping the Amp-Clamp jaws around one of the current-carrying lines, quick and accurate measurements can be obtained. The jaws are shaped to allow easy insertion into crowded wire assemblies.

1.1.3 The 294-2 measures AC current within 3 percent accuracy. The 295-2 measures both AC current and AC voltage within 3 percent accuracy; the voltage measurements are made with test leads supplied with each instrument. The 296-2 measures AC current, AC voltage and resistance within 3 percent

accuracy. A self-contained 1.5 volt (AAA size) alkaline battery supplies the power for resistance measurements. The resistance circuit is protected by a ¼ ampere fuse, with a spare fuse provided. Both battery and fuses are readily accessible under the coverplate on the bottom of the Instrument.

1.2 SUPPLIES AND ACCESSORIES

1.2.1 All supplies and accessories required for the operation of each Instrument are furnished with it and listed in Table 1-2.

1.3 SAFETY CONSIDERATIONS

1.3.1 This Operator's Manual contains cautions and warnings alerting the user to hazardous operating and service conditions. This information is flagged by CAUTION or WARNING headings throughout this publication, where applicable, and is defined at the front of the manual under SAFETY SYMBOLS. To ensure the safety of operating and servicing personnel and to retain the operating conditions of the Instrument, these instructions must be adhered to.

1.4 TECHNICAL DATA

1.4.1 Table 1-1 lists the technical data for the

Introduction

Simpson Amp-Clamp Instruments.

,6,1,5,3,0

Table 1-1. Technical Data

(1) AC Current, 294-2, 295-2 and 296-2

Ranges:	0-6, 15, 30, 150 and 300 rms Amperes.
Accuracy:	±3% of full scale at 60 Hz sine wave with conductor centered.
Temperature Error:	Less than 1% of full scale between 15°C to 35°C.

(2) AC Voltage, 295-2 & 296-2

Ranges:	0-30, 150, 300 and 600 rms Volts.
Accuracy:	±3% of full scale at 60 Hz sine wave.
Temperature Error:	0.5% of full scale max. (between 15°C and 35°C).

(3) Resistance, 296-2

Range:	0-500 Ohms (25 ohm center)
Accuracy:	±3% of scale arc

(4) Rated Circuit-to-Ground Voltage*

600V rms Max.
(850V peak)

(5)	Weight:	15 oz. (.425 kg.)
(6)	Dimensions:	10" long x 2.7" wide x 1.4" high (254 x 65.6 x 35.6 mm).

*NOTE *Per American National Standard C39.5 (April 1974), Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, RATED CIRCUIT-TO-GROUND VOLTAGE is defined to mean: "The specified voltage with respect to ground which may be safely and continuously applied to the circuits of an instrument."*

Table 1-2. Items and Accessories Included With This Instrument

Description	Part No.
294-2 295-2 296-2:	
Operator's Manual	6-111126
295-2:	
Test Lead, Probe	10-830738
Test Lead, Clip	10-830441
296-2:	
Test Lead, Probe	10-830738
Test Lead, Clip	10-830441
Battery, 1.5V AAA Alkaline	NEDA #24A
(2) Fuse, ¼ Ampere Type 8AG	5-11399*

Table 1-3. Additional Accessories

Description	Part No.
Carrying Case, Black Vinyl (294-2/295-2/296-2)	02226
Line Splitter, Simpson 151-2	00544

SECTION II
INSTALLATION

2.1 GENERAL

2.1.1 This section contains instructions for the installation and shipping of the 294-2, 295-2 and 296-2. Included are unpacking and inspection procedures, warranty, shipping, power source requirements, installation and care.

2.2 UNPACKING AND INSPECTION

2.2.1 Unpack the Instrument and inspect it for possible damage in shipment. Check the electrical performance as soon as possible. If damage is noted, notify the carrier and supplier before using the Instrument. Also, check that all items are included (Table 1-2).

2.2.2 Save the shipping carton and packing ma-

terials for future storing or shipping of the Instrument.

2.3 SHIPPING

2.3.1 Pack the Instrument carefully and ship it prepaid and insured to the proper destination.

2.4 WARRANTY

2.4.1 The Simpson Electric Company warranty policy is printed on the inside front cover of this manual. Read it carefully prior to requesting a warranty repair.

> **NOTE:** For assistance of any kind, including help with the Instrument under warranty, contact the nearest Authorized Service Center for instructions (listed on the last pages of this manual). If it is necessary to contact the factory directly, give full details of the difficulty and include the Instrument model number, serial number (at the back of the Instrument) and date of purchase. Service data or shipping instructions will be mailed promptly. If an estimate of charges for non-warranty or other service work is required, a maximum charge estimate will be quoted.

This charge will not be exceeded without prior approval.

2.5 POWER SOURCE REQUIREMENTS

2.5.1 The 294-2/295-2 Amp-Clamps do not require the use of batteries or an external power source.

2.5.2 The 296-2 requires the use of a battery for powering the resistance measuring circuit. One 1.5 volt AAA alkaline (NEDA No. 24A) cell is used. (Refer to paragraph 6.2 for battery installation.)

2.6 INSTALLATION

2.6.1 These Instruments can be used in any position convenient to the operator.

2.7 CARE

2.7.1 Immediately remove any materials spilled on the Amp-Clamp. Use only a mild detergent in water or alcohol (wood grain, isopropyl or denatured) solvent. Other solvents may damage the plastic and/or reduce the effectiveness of the insulation. Dry the Instrument thoroughly before using it.

2.7.2 Magnetic joint surfaces at the jaw locking area should be kept clean from residues of wire in-

sulation or any other particles and free from dust and dirt. Also, by keeping the jaws completely closed, the reluctance of the magnetic core is held to a minimum, thereby assuring full accurate current readings.

SECTION III
CONTROLS, CONNECTORS AND INDICATOR

3.1 GENERAL

3.1.1 This section describes all operating controls, connectors and indicators of the 294-2/295-2/296-2. Become familiar with each Instrument prior to operating it.

3.2 DESCRIPTION

3.2.1 Table 3-1 lists all controls, connectors, and the indicators. Figure 3-1 identifies them.

Table 3-1. Controls, Connectors and Indicator

1.	Range Selector Switch Switch Position 6A, 15A, 30A, 60A, 150A, 300A (294-2/295-2/296-2)	Selects the desired range setting for AC current. Measurements are made by clamping jaws around a

30V, 150V, 300V, 600V (295-2 & 296-2)	single current carrying conductor. Selects desired range setting for AC volts. Voltage is measured with leads (supplied).
OHMS (296-2)	Selects circuit required for resistance measurements. The resistance is measured with test leads (supplied).
2. Ohms Adjust (296-2)	This control zero adjusts the Instrument with test leads shorted together.
3. Pointer Zero Adjust	This control adjusts the pointer to coincide with the zero point on the dial with no input signal.
4. Terminals 295-2 & 296-2)	The terminals are the input for the voltage and resistance measurements and have no polarity or ground reference.
5. Pointer	The pointer indicates the value of the measured parameter (amperes, volts, resistance).
6. Pointer Lock Lever	When lifted toward the

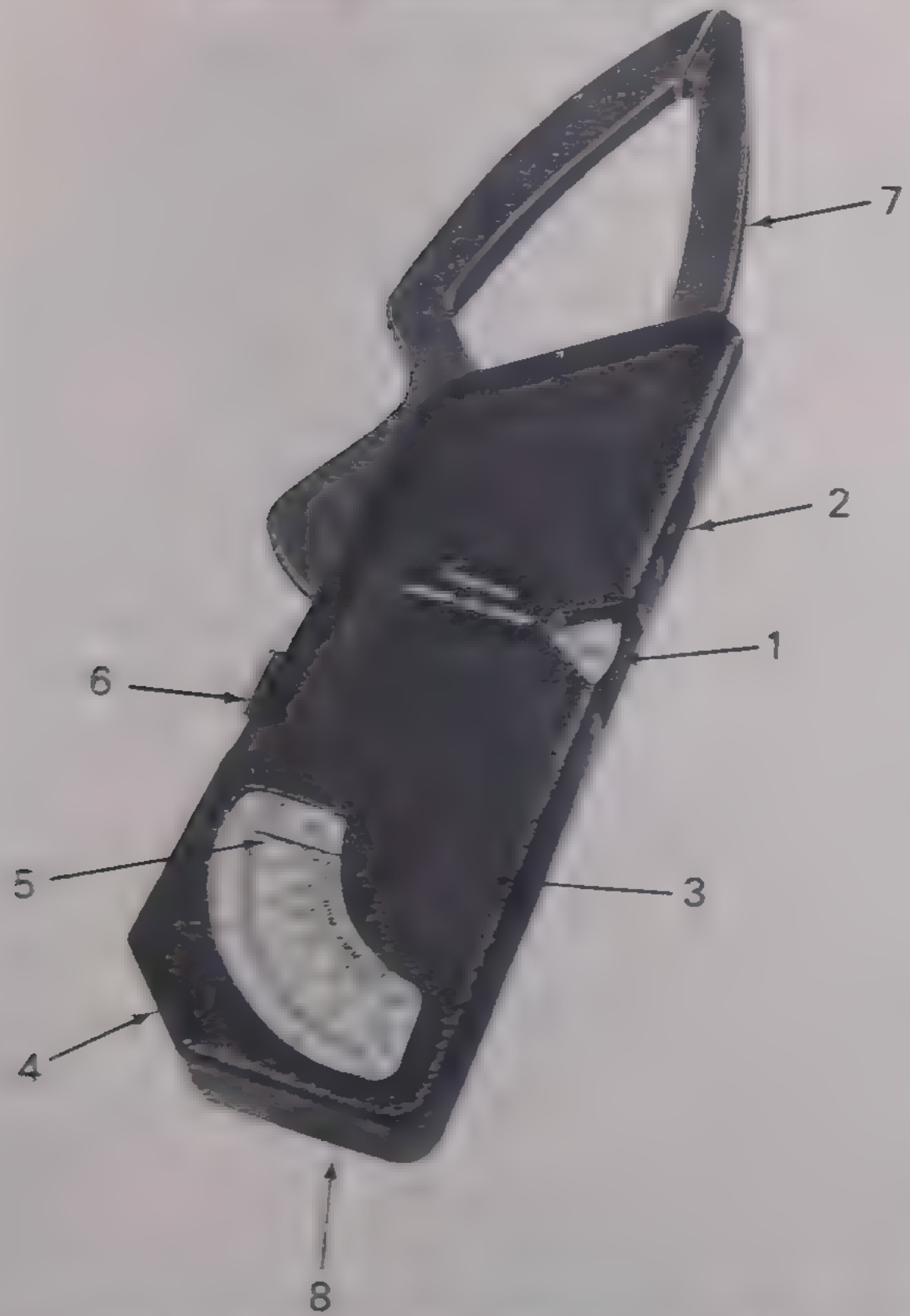

Figure 3-1. Controls, Connectors and Indicator

	front of the Instrument, the lever locks the pointer to the dial. The pointer is released when the lever is set to the rear position.
7. Clamp Jaws	Used for making AC current measurements. The spring-loaded jaws are clamped around a single current-carrying conductor.
8. Battery & Fuse (296-2) Compartment Cover	This cover provides access to the battery and fuse compartment. A spare fuse is also provided inside the compartment.

SECTION IV
OPERATION

WARNING

Before proceeding with the operation of these Instruments, review the SHOCK HAZARD definition at the front of this manual.

4.1 GENERAL

4.1.1 This section of the manual contains all the information required to use and operate 294-2 295-2 296-2 in a safe and proper manner. Special notes and instructions have also been provided for added safety and convenience.

4.2 SAFETY PRECAUTIONS

4.2.1 These Instruments are designed to be used only by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury.

4.2.2 Do not work alone when making measurements where a shock hazard can exist. Notify a nearby person that you are making, or intend to make, such measurements.

4.2.3 Voltages might appear unexpectedly in defective equipment. Whenever possible, remove all power from the circuit when making connections or disconnections.

4.2.4 Locate all voltage and current accessibility paths prior to making any measurement or connections of equipment under test.

4.2.5 Inspect the Instrument and test leads for

cracks, breaks or crazes in the insulation and replace the defective item(s) immediately.

4.2.6 Do not make measurements in a circuit where corona is present. Corona can be identified by a pale blue color emanating from sharp metal points in the circuit, or by a buzzing sound, or by the odor of ozone. In rare instances, such as around germicidal lamps, ozone might be generated as a normal function. Ordinarily the presence of ozone indicates presence of high voltage, and possibly an electrical malfunction of some kind.

4.2.7 Hands, shoes, floor and workbench must be dry. Avoid making measurements under humid, damp or other environmental conditions that could affect the dielectric withstanding voltage of the test leads of the Instrument.

4.2.8 Do not use test leads which differ from those originally furnished with the Instrument. When using the insulated alligator clip leads for voltage measurement (295-2 and 296-2) ensure that the Insulator boot covers all exposed metal at the connection.

4.2.9 Do not connect an Instrument to any circuit in which the voltage, with respect to ground, exceeds the rated circuit-to-ground voltage specified

in Table 1-1 (Item 4).

4.3 AC CURRENT MEASUREMENTS. 294-2 295-2 296-2:

a. READ AND HEED THE SAFETY PRECAUTIONS IN PARAGRAPH 4.2.

b. Disconnect the test leads from the Instrument.

c. Set the range selector switch to the appropriate ampere range. If the magnitude of the current being measured is unknown, start with the 300 ampere range.

d. Clamp the jaws of the Amp-Clamp around one (only) of the current-carrying wires to be measured. Make certain the jaws are completely closed.

> **NOTE:** There will be no meter indication if the Amp-Clamp jaws are clamped around both conductors, as in a power cord, because the opposing magnetic fields will cancel each other.

e. Reset the range selector switch, if necessary, to obtain pointer indication in the upper portion of the scale for maximum reading accuracy.

f. Read the current value from the appropriate

scale as indicated by the selector switch position.

g. If the Amp-Clamp is in a position where the pointer position cannot be accurately seen, the pointer lock actuator can be flipped up with a finger. This will clamp the pointer to permit reading the indicated value after removing it from the wire.

4.4 AC VOLTAGE MEASUREMENTS, 295-2 and 296-2:

a. READ AND HEED THE SAFETY PRECAUTIONS IN PARAGRAPH 4.2.

b. Connect the test leads to the AMP-Clamp input terminals and twist the connectors ⅛ turn to lock them in place.

c. Set the range selector switch to the appropriate voltage range. If not known, start with the 600 volt range.

d. If possible, remove all power and discharge any capacitors in the circuit to be measured. Test leads may be used to make connections. Make certain that the lead insulation boots cover the metal clips.

e. If power cannot be removed, remove the clip

from the red probe, connect the black test lead to the ground side of the circuit and use the red probe to contact the live side of the circuit. Keep hands away from live parts.

f. Connect test leads to the circuit and apply power.

g. Reset the range selector switch, if necessary, to obtain a pointer indication in the upper portion of the scale for maximum reading accuracy.

h. Read the voltage value from the appropriate scale as indicated by the selector switch position.

i. Remove power and discharge any capacitors before disconnecting test lead connections.

4.5 RESISTANCE MEASUREMENTS, 296-2:

a. MAKE CERTAIN ALL POWER IS REMOVED AND ALL CAPACITORS IN THE CIRCUIT ARE DISCHARGED BEFORE IN-CIRCUIT RESISTANCE MEASUREMENTS ARE TO BE MADE.

b. Connect the test leads to the Amp-Clamp input terminals and twist the connectors ⅛ turn to lock them in place.

c. Set selector switch to OHMS position.

d. Short the leads and adjust Ohms adjust knob for

zero Ohms indication. (If there is no pointer deflection, check fuse. If pointer deflects but cannot be adjusted to zero Ohms, replace battery.)

e. Connect test leads across resistance being measured. Read resistance on Ohms scale of meter.

4.6 APPLICATION INFORMATION

4.6.1 Current Measurements, 294-2/295-2/296-2:

a. The Amp-Clamp is a practical and valuable electrical testing tool. It is largely used for tracing faults, diagnosing operating troubles and checking and/or balancing distribution circuits without initially turning the power off to install an ammeter. It can be used to measure the running current of electric motors without the problem of bypassing the heavy starting current.

b. Because current can only be measured through a single conductor, a useful accessory, Simpson 151-2 Line Splitter(Catalog No. 00544) can be used with the Amp-Clamp in checking equipment where the conductors are encased in a single cord, or cannot be isolated.

4.6.2 Sensitivity Increase

4.6.2.1 The 151-2 Line Splitter also provides a con-

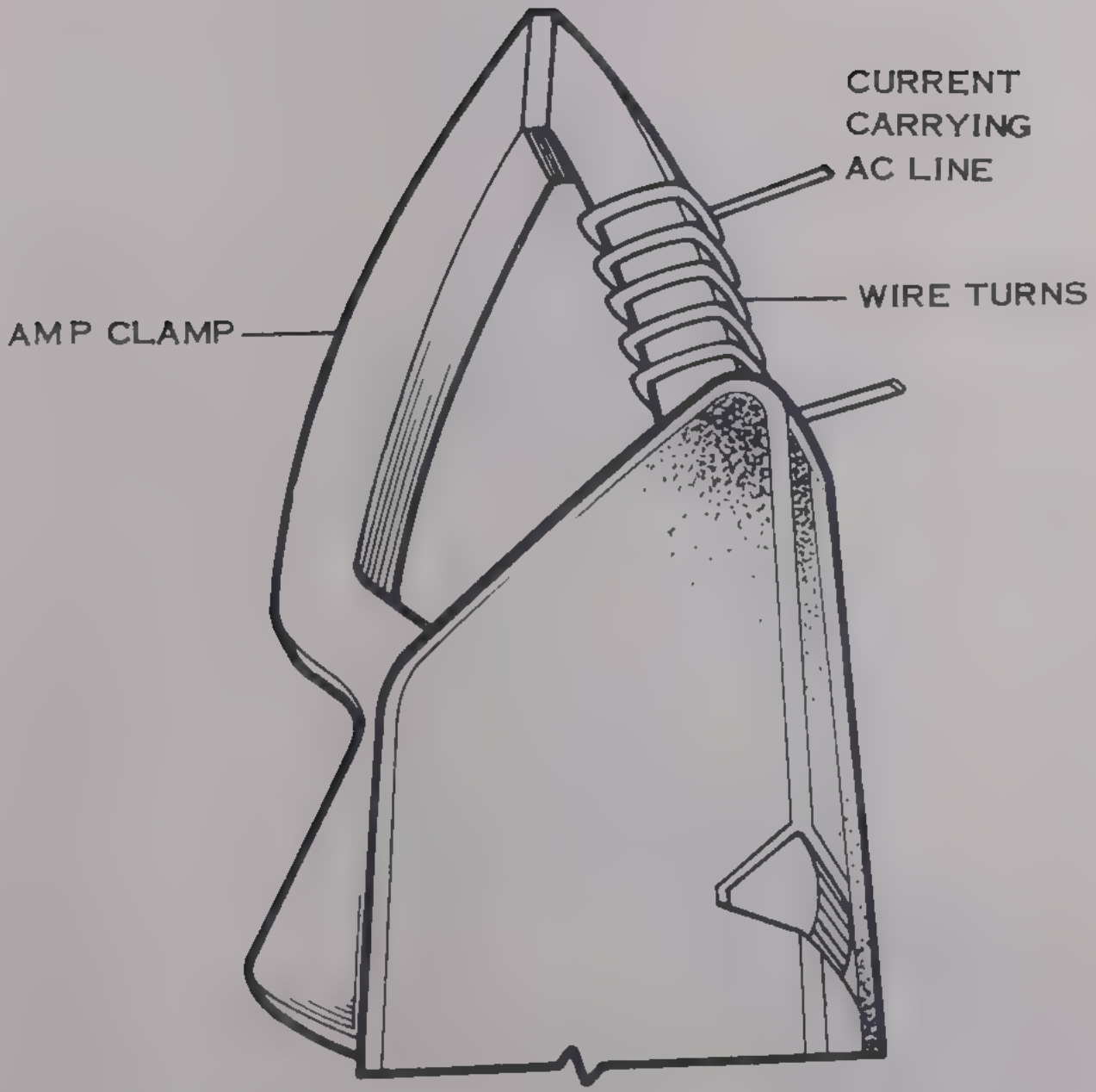

Figure 4-1. Increasing Sensitivity of Amp-Clamp

venient means of increasing the sensitivity of the Amp-Clamp by a factor of 10.

4.6.2.2 As stated in Section V, the Amp-Clamp functions as a split-core transformer. Other multiples of increased sensitivity can be obtained by winding turns around one of the jaws of the Amp-Clamp, as shown in Figure 4-1.

4.6.2.3 If 10 turns are wound on the jaw, and range selector is set on the 6-amp range, then a current of 600 milliamperes in the current-carrying AC line will read full scale on the indicator. Divide the reading on the scale by 10 to obtain the actual current.

4.6.3 Voltage Measurements, 295-2 and 296-2:

4.6.3.1 The voltage ranges on the Amp-Clamp were selected so that the line voltages of 120, 240 and 480 volts could be accurately determined. The 30-volt range is useful in checking thermostat circuits in heating and air-conditioning applications.

4.6.4 Resistance Measurements, 296-2:

a. The resistance range can be used to accurately measure low values of resistance between zero and 500 Ohms. This ohmmeter feature is also useful as a continuity tester for checking motor windings, fuses, switches, etc.

b. The resistance range can be used to check a capacitor for a serious fault. When connected, the capacitor's charging current will cause a momentary deflection toward zero ohms and a slow return to infinity as the capacitor charges. The amount of deflection and time to return to infinity are proportional to the capacitance. Small capacitances will produce a deflection so small as to be difficult to observe. A faulty capacitor will, however, indicate a fixed resistance value (shorted) or will not produce a momentary deflection of the meter (open). Once charged, the capacitor cannot be rechecked until first discharged.

c. The resistance range may be used to check semiconductors for open or shorted junctions.

SECTION V
THEORY OF OPERATION

5.1 AC CURRENT MEASUREMENTS

5.1.1 The Amp-Clamp(s), in effect, functions as a split core transformer to measure current in a conductor under test. The current-carrying conductor acts as a transformer primary, and a coil on the clamp core serves as the secondary. The magnetic

field that surrounds the current-carrying conductor induces a voltage, which is proportional to the current, into the secondary coil. This voltage is rectified and applied to the indicating circuit.

5.2 AC VOLTAGE MEASUREMENTS

5.2.1 Measured voltages are reduced in value by series-dropping resistors, then rectified and applied to the indicating circuit.

5.3 RESISTANCE MEASUREMENTS

5.3.1 The unknown resistance is placed in series with the battery and the Amp-Clamp indicator circuit. The indicating circuit consists of a meter shunted by a fixed resistor. When zero resistance is being measured, or input leads are shorted, maximum current flows in the circuit and the Amp-Clamp indicates a full scale deflection of zero Ohms. When the unknown resistance is equal to the fixed shunt resistor, the Amp-Clamp indicates ½ full scale deflection. Thus, the value of the resistance being measured controls the amount of current in the indicating circuit.

SECTION VI
OPERATOR SERVICING

6.1 GENERAL

6.1.1 This section describes the procedures needed to effectively service these Instruments. Careful adherence to these routine steps will aid in the overall life of these Instruments and avoid any possible failure.

6.2 BATTERY INSTALLATION (296-2 ONLY)

6.2.1 Proceed as follows (Figure 6-1):

a. Remove battery and fuse compartment cover located at the bottom of the case by pressing cover in at the serrated end and sliding it toward the terminal side of the case. This exposes the protective and spare fuses.

b. Install the battery, making sure that the positive (+) end is inserted into the bottom of the compartment.

c. To replace the compartment cover, slide the serrated end in first.

6.3 BATTERY REMOVAL

6.3.1 Remove the battery from the Amp-Clamp

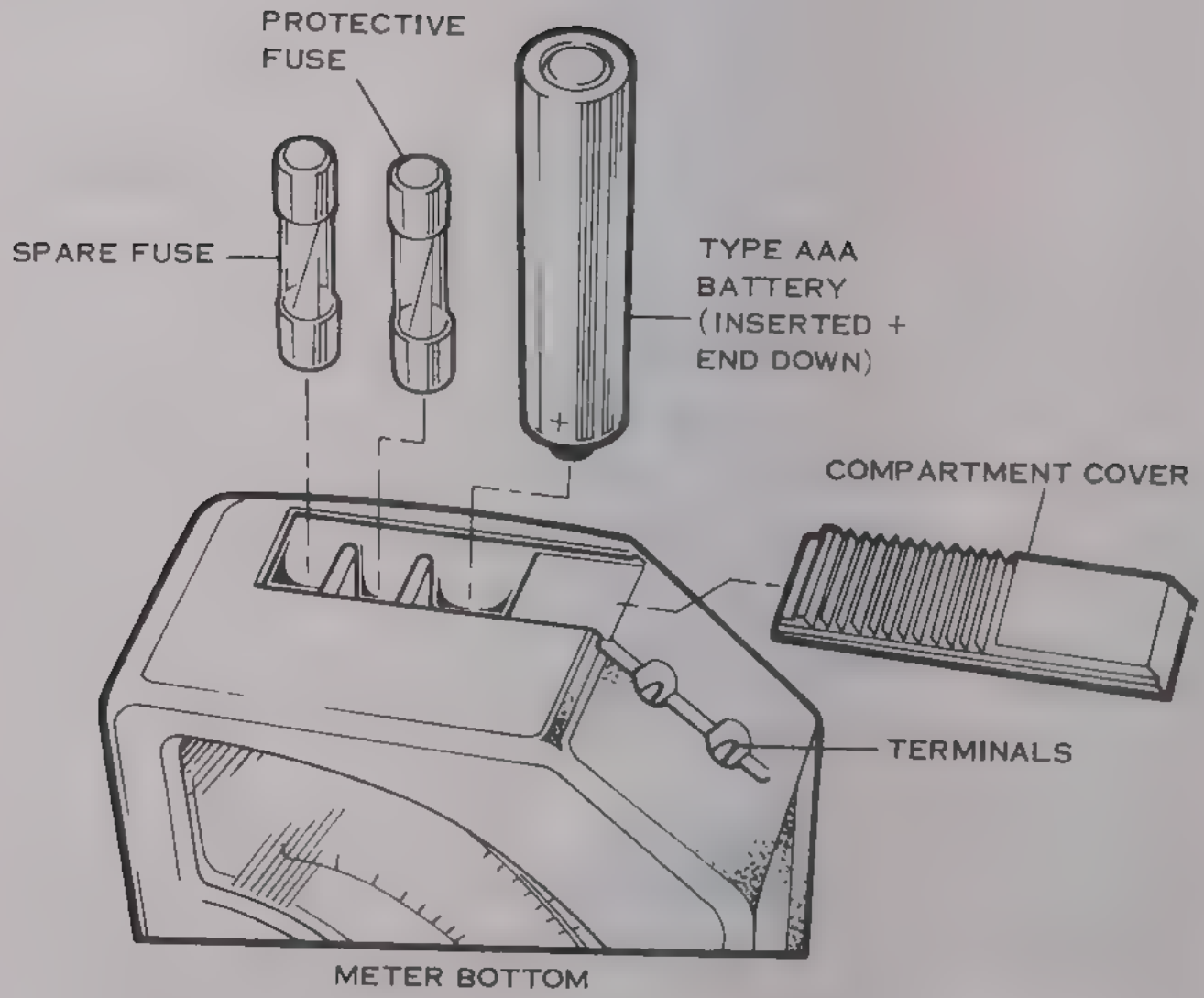

Figure 6-1. Battery Installation and Fuse Location (296-2 Only)

when it is to be stored for long periods of time or when the battery is run down. The condition of the battery is checked by setting Range Selector to OHMS, connecting the Instrument leads to terminal and shorting leads together. Inability to adjust pointer to zero indicates a weak battery. (Refer to Figure 6-1 for battery location.)

6.4 FUSE

6.4.1 The fuse is in the circuit during resistance measuring, and out of the circuit during current or voltage measurements. The active fuse is next to the battery compartment, while the spare fuse is in the outer compartment. Replace the fuse (following instructions in paragraph 6.2) with a ¼ amp, Type 8AG fuse.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

SECTION VII
SERVICING INSTRUCTIONS

7.1 GENERAL

7.1.1 This section contains information for ordering replacement parts. Tables 7-1, 7-2, and 7-3 list parts for the 294-2/295-2/296-2 in alphanumeric order of their reference designators and indicates the description. (Refer to Table 1-2 for items and accessories furnished with this Instrument.)

7.1.2 To obtain replacement parts, address order to the nearest Authorized Service Center (listed on the last pages of this manual). (Refer to paragraph 2.4.1 for ordering instructions.)

7.2 REPLACEMENT PARTS AND SCHEMATIC DIAGRAM

Table 7-1. Replacement Parts List (294-2)

Reference Symbol	Description	Part No.
CR1, CR2	Diode, 1N276	1-115970
CR3	Diode	1-110670
L1	Coil	6-111318
R1, R2	Resistor, 5 kΩ ±1%	5-116677
R3	Potentiometer, 100 kΩ	5-116664
R4, R5	Potentiometer, 10 kΩ	5-116663

R6	Potentiometer, 330 kΩ	5-116662
R7	Resistor, 32Ω ±1%	5-116809
R8	Resistor, 64.5Ω ±1%	5-116669
R9	Resistor, 171Ω ±1%	5-116670
R10	Resistor, 380Ω ±1%	5-116671
R11	Resistor, 750Ω ±1%	5-116672
R12	Resistor, 7.5kΩ ±1%	5-116678
R13	Resistor, 3.38kΩ ±1%	5-116675
	Housing Assembly, Top	10-864202
	Housing Assembly, Bottom	10-864211
	Actuator, Pointer Lock	6-111568
	Knob, Range Selector	3-260591
	Label, Range Selector	5-116814
	Ring, Retaining	5-112657

Table 7-2. Replacement Parts List (295-2)

Reference Symbol	Description	Part No.
CR1, CR2	Diode, 1N276	1-115970
CR3	Diode	1-110670
L1	Coil	6-111318
R1, R2	Resistor, 5kΩ ±1%	5-116677
R3	Potentiometer, 100kΩ ±1%	5-116664
R4, R5	Potentiometer, 10kΩ ±20%	5-116663

Servicing Instructions

R6	Potentiometer, 330Ω ±20%	5-116662
R7	Resistor, 28.5kΩ ±1%	5-116679
R8	Resistor, 120kΩ ±1%	5-116680
R9	Resistor, 150kΩ ±1%	5-116681
R10	Resistor, 300kΩ ±1%	5-116808
R11	Resistor, 32Ω ±1%	5-116809
R12	Resistor, 64.5Ω ±1%	5-116669
R13	Resistor, 171Ω ±1%	5-116670
R14	Resitsor, 380Ω ±1%	5-116671
R15	Resistor, 750Ω ±1%	5-116672
R16	Resistor, 7.5kΩ ±1%	5-116678
R17	Resistor, 3.38kΩ ±1%	5-116675
R18	Resistor, 3.82kΩ ±1%	5-116676
R19	Resistor, 2.03kΩ ±1%	5-116674
	Test Lead, Probe	10-830738
	Test Lead, Clip	10-830441
	Alligator Clip (without insulator)	6-111226
	Insulator Alligator Clip, Black	6-111225
	Housing Assembly, Top	10-864203
	Housing Assembly, Bottom	10-864210
	Actuator, Pointer Lock	6-111568
	Knob, Range Selector	3-260640
	Label, Range Selector	5-116815

Table 7-3. Replacement Parts List (296-2)

Reference Symbol	Description	Part No.
CR1, CR2	Diode, 1N276	1-115970
CR3	Diode	1-110670
F1	Fuse, 1/4A, 3AG	5-113997
L1	Coil	6-111318
R1, R2	Resistor, 5kΩ ±1%	5-116677
R3	Potentiometer, 100kΩ ±20%	5-116664
R4, R5	Potentiometer, 10kΩ ±20%	5-116663
R6	Potentiometer, 3300Ω ±20%	5-116662
R7	Resistor, 28.5kΩ ±1%	5-116679
R8	Resistor, 12kΩ ±1%	5-116680
R9	Resistor, 15kΩ ±1%	5-117895
R10	Resistor, 30kΩ ±1%	5-116808
R11	Resistor, 9330Ω ±1%	5-116673
R12	Potentiometer, 5kΩ ±20%	5-116634
R13	Resistor, 332Ω ±1%	5-116809
R14	Resistor, 64.9Ω ±1%	5-116669
R15	Resistor, 1710Ω ±1%	5-116670
R16	Resistor, 3830Ω ±1%	5-116671
R17	Resistor, 750Ω ±1%	5-116672
R18	Resistor, 7.5kΩ ±1%	5-116678
R19	Resistor, 20.5Ω ±1%	10-475493
R20	Resistor, 3.33kΩ ±1%	5-116675
R21	Resistor, 3.82kΩ ±1%	5-116676

R22	Resistor, 2.03kΩ ±1%	5-116674
	Battery, Alkaline AAA, 1.5V	Eveready
	Test Lead, Probe	10-830738
	Test Lead, Clip	10-830441
	Alligator Clip (without Insulator)	6-111226
	Insulator Alligator Clip, Black	6-111225
	Housing Assembly, Top	10-864204
	Housing Assembly, Bottom	10-864209
	Cover, Battery & Fuse Compartment	10-560242
	Actuator, Pointer Lock	6-111568
	Knob, Range Selector	3-260640
	Label, Range Selector	5-116816

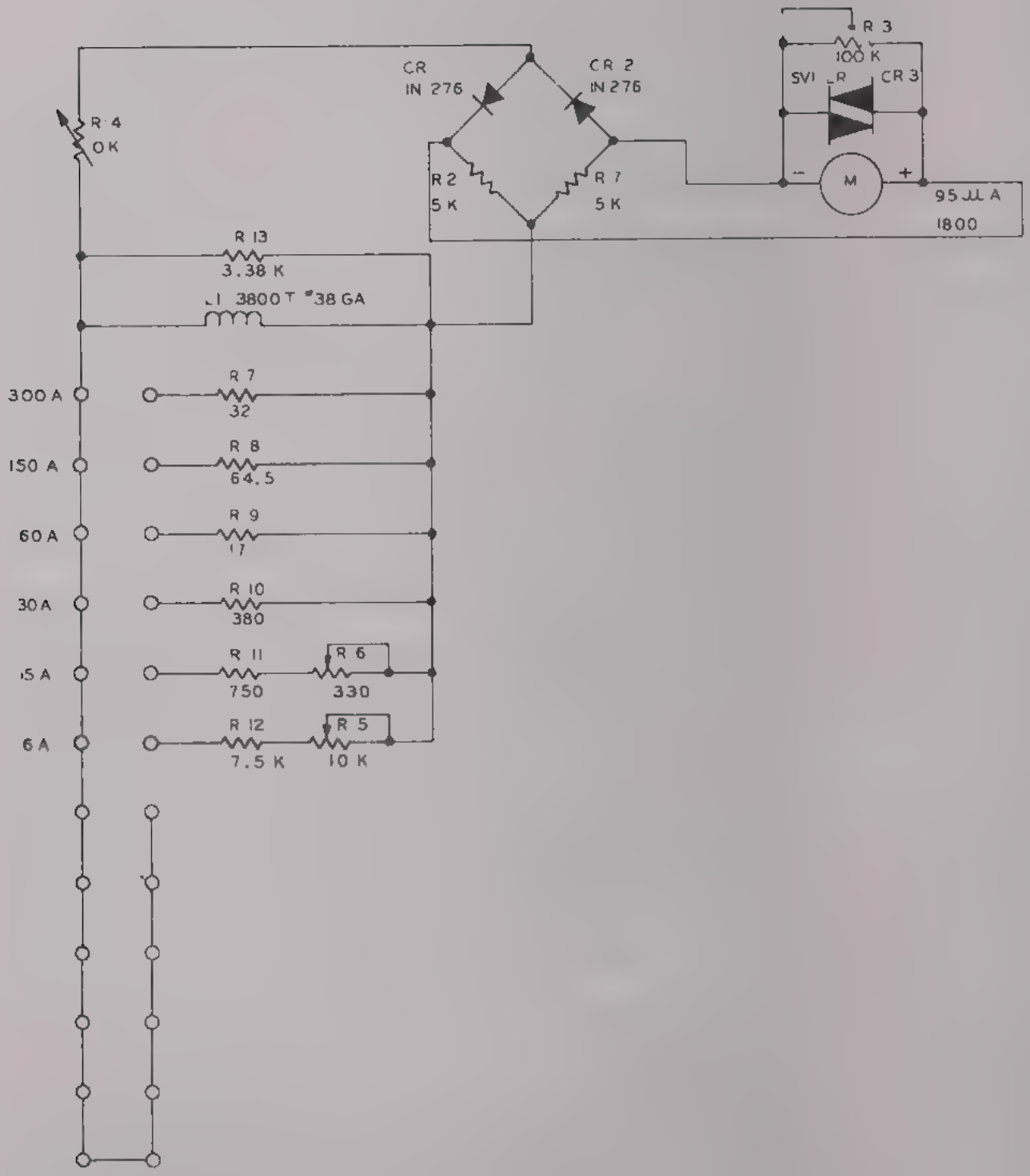

Figure 7-1. Schematic Diagram (294-2)

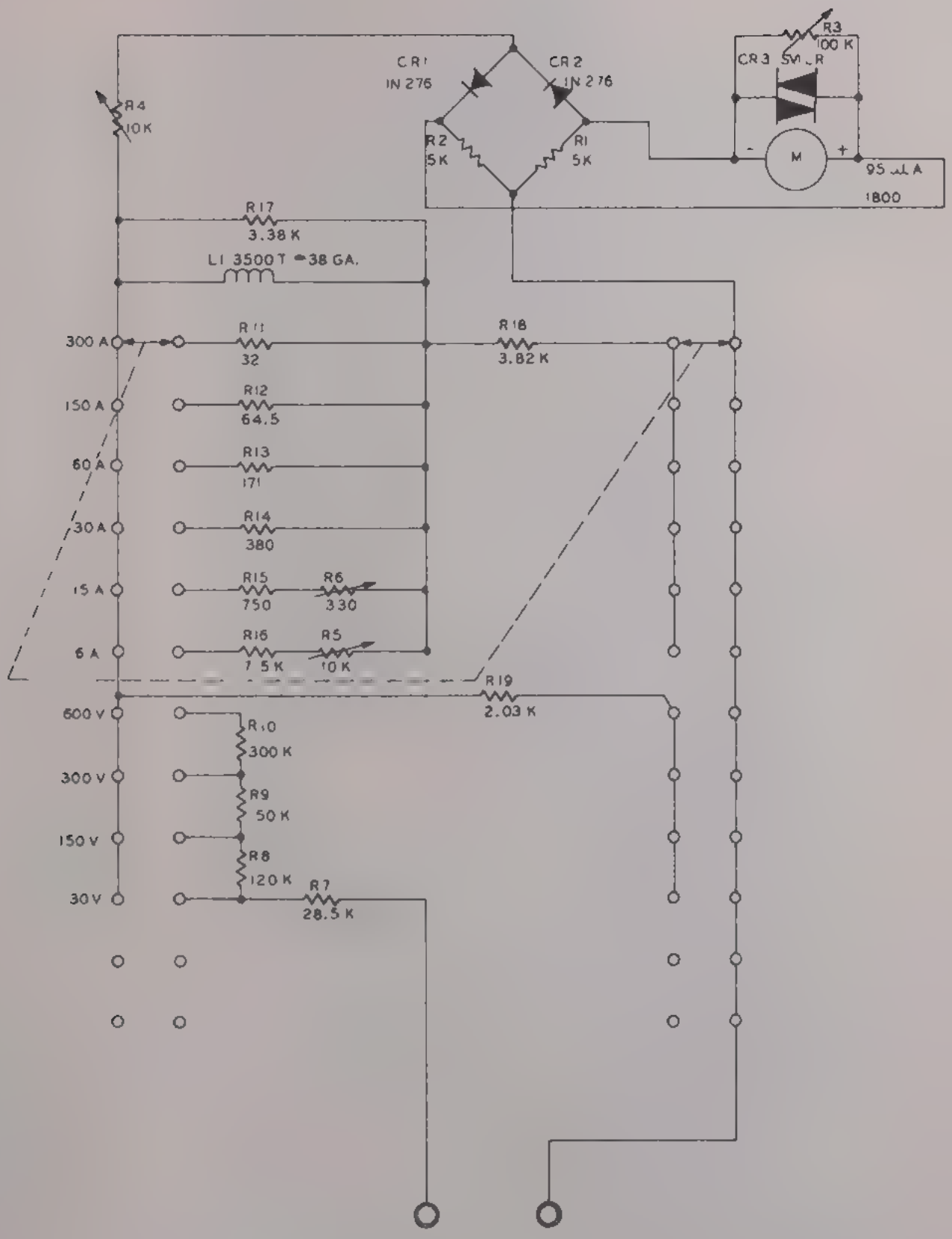

Figure 7-2. Schematic Diagram (295-2)

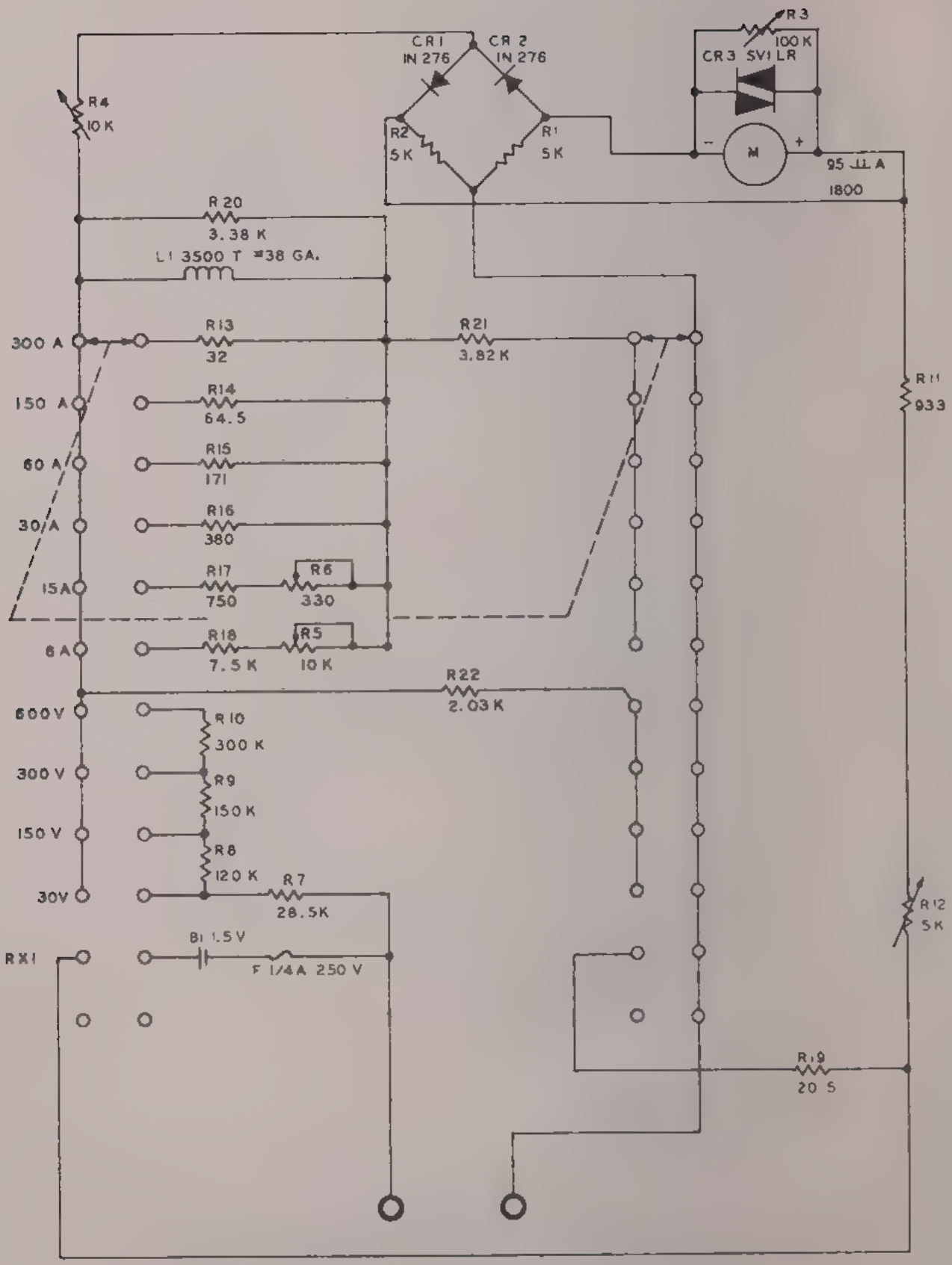

Figure 7-3. Schematic Diagram (296-2)

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